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PROGRAM LIBRARY

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TITLE	QUBIC
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QUBIC

DECUS Program Library Write-up

DECUS No. 8-261

ABSTRACT

'QUBIC' PLAYS 3 DIMENSIONAL TIC-TAC-TOE ON AN ORDER-4 CUBE. THE PROGRAM IS CONVERSATIONAL AND USES THE TELETYPE FOR ALL I/O. MOVES ARE TYPED IN AS 3 COORDINATES, AND OUTPUTTED USING BOTH COORDINATES AND A TELETYPE PRINTOUT OF THE PLAYING BOARD. THE STRATEGIES EMPLOYED IN PLAYING THE GAME HAVE BEEN FOUND TO BE EXTREMELY GOOD, BUT THE PROGRAM CAN BE BEATEN.

REQUIREMENTS

A PDP-8, PDP-8/I, OR PDP-8/L WITH 4K OF MEMORY AND AN ASR-33 TELETYPE.

LOADING PROCEDURE

LOAD WITH THE STANDARD BINARY LOADER.

OPERATING PROCEDURE

TURN THE TELETYPE TO LINE, SET SR=0200, PRESS 'LOAD ADDRESS', THEN PRESS 'START'.

THE COMPUTER THEN TYPES A SIGN-ON MESSAGE AND ASKS A SERIES OF QUESTIONS. THE QUESTIONS AND THEIR MEANINGS ARE LISTED IN TABLE I.

TABLE I

TELETYPE OUTPUT	DESCRIPTION
DO YOU WANT AN EXPLANATION OF HOW TO PLAY ?	ANSWER 'YES' OR 'NO'. IF THE 'YES' OPTION IS SELECTED, A BRIEF DESCRIPTION OF THE GAME WILL BE TYPED.
BOARD PRINTOUT ?	ANSWER 'YES' OR 'NO'. IF THE 'YES' OPTION IS SELECTED, THE PLAYING BOARD WILL BE PRINTED OUT AFTER EVERY COMPUTER MOVE. IF 'NO' IS TYPED, THE BOARD WILL BE PRINTED ONLY AFTER A WIN OR LOSS. (SEE APPENDIX A.)
SHALL I GO FIRST ?	ANSWER 'YES' OR 'NO'. IF 'YES' IS TYPED, THE COMPUTER WILL MAKE THE FIRST MOVE, OTHERWISE, YOU WILL GO FIRST.

YOUR MOVE IS

INPUT YOUR MOVE AS 3 COORDINATES FROM 1 TO 4 INCLUSIVE. TYPE IN THE ORDER ROW, COLUMN, PLANE. (THE TOP ROW AND LEFTMOST COLUMN OF THE TOP PLANE WOULD BE TYPED 1,1,1.)

HOW ABOUT ANOTHER GAME ?

TYPED AFTER A WIN, LOSS, OR TIE. ANSWERING 'YES' WILL RESTART THE PROGRAM, AND TYPING 'NO' WILL HALT IT WITH PC=0200.

TYPING ERROR RECOVERY

TYPING ANSWERS OTHER THAN THOSE BEGINNING WITH 'Y' OR 'N' WILL CAUSE AN ERROR MESSAGE TO BE TYPED AND THE QUESTION ASKED AGAIN.

IF ANY CHARACTERS OTHER THAN 1 THROUGH 4 ARE TYPED FOR MOVE INPUT, OR IF THE SPECIFIED SQUARE IS ALREADY OCCUPIED, AN ILLEGAL MOVE MESSAGE WILL BE PRINTED AND THE MOVE ASKED FOR AGAIN.

TYPING A BACK ARROW (SHIFT/O) BEFORE TYPING THE LAST COORDINATE OF AN INPUTTED MOVE DELETES THAT MOVE AND ASKS FOR A NEW ONE.

OUTPUT

AFTER THE INPUT OF EVERY USER MOVE, THE COMPUTER DETERMINES ITS MOVE AND OUTPUTS IT BY TYPING 'I MOVE' FOLLOWED BY THREE COORDINATES OF THE SAME FORM AS THOSE USED ON INPUT. WHEN THE COMPUTER WINS, IT TYPES 'I WIN ON' FOLLOWED BY THE 3 COORDINATES OF EACH OF THE 4 SQUARES ON THE WINNING PATH. IF THE HUMAN OPPONENT WINS, THE COMPUTER TYPES 'YOU WIN ON' FOLLOWED BY A SET OF SIMILAR COORDINATES. A TIE SIMPLY CAUSES A MESSAGE INDICATING A TIE TO BE TYPED OUT. IN ALL CASES EXCEPT A TIE, THE PLAYING BOARD IS PRINTED OUT AFTER THE MESSAGE. (SEE APPENDIX A.)

CONTROL OPTIONS

WHENEVER THE PROGRAM IS IN AN INPUT WAITING LOOP, TYPING CERTAIN CONTROL CHARACTERS WILL CAUSE BRANCHING TO OTHER PARTS OF THE PROGRAM. THESE CHARACTERS ARE LISTED IN TABLE II.

TABLE II

CHARACTER

PROGRAM ACTION

CONTROL/N

INTERRUPTS THE CURRENT GAME AND STARTS A NEW ONE.

CONTROL/S

TYPES THE SIGN-OFF MESSAGE AND
HALTS THE COMPUTER WITH PC=0200.

THE GAME OF ORDER-4 3D TIC-TAC-TOE

THREE DIMENSIONAL TIC-TAC-TOE IS SIMILAR TO THE MORE FAMILIAR PLANAR TIC-TAC-TOE. THE OBJECT STILL IS TO GET 4 IN A ROW, BUT A CUBE PROVIDES MANY ADDED COMPLEXITIES AND WINNING PATHS. IN ADDITION TO STANDARD PLANAR CONFIGURATIONS IN ANY OF THE HORIZONTAL OR VERTICAL PLANES, DIAGONALS CAN BE MADE FROM OPPOSITE CORNERS OF THE CUBE. HENCE A COMPLEX THREE DIMENSIONAL NETWORK OF SQUARES MAKES THE TRIVIAL GAME OF TIC-TAC-TOE RATHER CHALLENGING.

THE ALGORITHM USED TO COMPUTE MOVES IN THIS PROGRAM WAS DEVELOPED BY ROBERT K. LOUDEN IN HIS BOOK, "PROGRAMMING THE IBM 1130 AND 1800." A BRIEF SUMMARY OF THIS ALGORITHM FOLLOWS.

IN MEMORY, THE PLAYING BOARD IS REPRESENTED BY A 64-LOCATION ARRAY. THE FOLLOWING CONVENTIONS ARE USED TO INDICATE THE STATUS OF EACH SQUARE: 0 SIGNIFIES AN EMPTY SQUARE, 1 INDICATES OCCUPATION BY THE HUMAN OPPONENT, AND 5 MEANS THE SQUARE IS OCCUPIED BY THE COMPUTER. THIS SYSTEM ALLOWS US TO DETERMINE STRATEGIC INFORMATION BY SUMMING UP THE 76 POSSIBLE WINNING PATHS: A SUM OF 3 INDICATES THE OPPOSITION HAS THREE IN A ROW AND MUST BE BLOCKED, A SUM OF 15 SHOWS THE COMPUTER HAS THREE IN A ROW AND WILL WIN ON THE NEXT MOVE, AND SO FORTH. A SYSTEM INVOLVING 3 WANTED SUM VALUES, LABELED TEST1, TEST2, AND TEST3, WHICH INCORPORATES THE MOST IMPORTANT STRATEGIC SITUATIONS, MAY BE SUMMARIZED AS FOLLOWS:

FIND A BLANK SQUARE M1 ON A ROW WITH A SUM OF TEST1, SUCH THAT M1 IS ALSO ON A ROW OF SUM TEST2, WHICH CONTAINS A BLANK SQUARE M2 WHICH ALSO LIES ON A ROW OF SUM TEST3.

M1 IS THE BEST MOVE, AND M2 IS AN ALTERNATE. OFTEN ALL THREE TEST NUMBERS ARE NOT NEEDED TO ESTABLISH A SITUATION; HERE, A POSITIVE VALUE FOR A TEST NUMBER TERMINATES THE SEARCH. THIS ALGORITHM REQUIRES AN ARRAY CONTAINING THE VARIOUS SETS OF TEST NUMBERS IN ORDER OF IMPORTANCE, A 64-LOCATION MOVE ARRAY, A 76 LOCATION SUM ARRAY TO STORE THE SUMS OF EACH OF THE WINNING PATHS, AND A 76*4 OR 304 LOCATION ROW ARRAY TO HOLD THE SUBSCRIPTS OF THE 4 SQUARES ON EACH WINNING PATH.

THE MAIN PROGRAM INPUTS MOVES AND CALLS A SUBROUTINE, REFERRED TO AS 'STRAT', TO DETERMINE THE COMPUTER'S MOVE ACCORDING TO THE GIVEN ALGORITHM. IF NONE OF THE TEST SITUATIONS ARE FOUND, AS IS OFTEN THE CASE EARLY IN THE GAME, A MOVE IS TAKEN FROM THE WAITING LIST, AN ARRAY CONTAINING THE SUBSCRIPTS OF SEVERAL OF THE MOST IMPORTANT SQUARES. RUNNING OUT OF WAITING MOVES RESULTS IN A TIE. IF A WIN OR LOSS IS DETECTED, M1 IS A SUBSCRIPT TO THE ROW ARRAY, WHICH ALLOWS THE PROGRAM TO GET THE SUBSCRIPTS OF THE 4 SQUARES ON THE WINNING ROW.

FOR A MORE DETAILED DESCRIPTION OF THE ALGORITHM, PLEASE SEE

REFERENCE 1.

THE MAIN PROGRAM CALLS SEVERAL SUBROUTINES TO DO A MAJOR PORTION OF THE WORK. SUBROUTINES ARE LISTED IN TABLE III.

TABLE III

SUBROUTINE POINTER OR CALL	DESCRIPTION
MESAGE	PRINTS OUT TEXT INFORMATION PACKED TWO CHARACTERS TO THE WORD. THE LOCATION FOLLOWING THE CALL CONTAINS THE STARTING ADDRESS OF THE TEXT BLOCK. THE STRING IS TERMINATED BY A 00, AND THE ROUTINE USES THE CODES 43 AND 45 FOR CR AND LF.
YESNO	READS CHARACTERS FROM THE KEYBOARD UNTIL A CR IS TYPED. IF THE FIRST CHARACTER TYPED IS A 'Y', RETURN TO CALL+2, IF AN 'N', RETURN TO CALL+1, AND IF NEITHER, TYPE AN ERROR MESSAGE AND ASK THE QUESTION AGAIN.
CODE	CHANGE ROW, COLUMN, PLANE COORDINATES TO 1-64 ROW ARRAY SUBSCRIPTS. LEAVE THE RESULT IN THE AC.
CONVRT	CONVERT 1-64 SUBSCRIPT IN THE AC TO ROW, COLUMN, PLANE COORDINATES. LEAVE THE RESULT IN 'ROW', 'COLUMN', AND 'PLANE'.
STRAT	DETERMINE THE COMPUTER'S MOVE. LEAVE AS A MOVE ARRAY SUBSCRIPT IN 'M1'. IF A WIN OR LOSS IS DETECTED, M1 IS A ROW SUBSCRIPT.
BOARD	PRINTS PLAYING BOARD (SEE APPENDIX A.)
'NEW INSTRUCTION' CALLS	
TESTAC	SKIP IF $260 < AC < 265$.
READC	SINGLE CHARACTER READ FROM KEYBOARD INTO AC.
PRINTC	SINGLE CHARACTER PRINT AND CLEAR

PROGRAM DESCRIPTION

PAGE ZERO

LOCATIONS

10-17

20-37

40-45

46-54

55-56

57-66

67-73

74-101

102-104

105-110

175-177

MAIN PROGRAM

200-214

215-234

235-250

251-302

USE

AUTO-INDEX POINTERS.

NUMERICAL CONSTANTS.

STORAGE FOR THE 3 COORDINATES, THE CODED SUBSCRIPT OF THE MOVE ARRAY ('NEXT'), A TEMPORARY STORAGE LOCATION, AND A FLAG TO RECORD BOARD PRINTOUT STATUS.

VARIABLES USED BY 'STRAT'.

WAIT LIST CONTROLLERS.

COUNTERS FOR SUBROUTINE 'STRAT'.

CONSTANTS FOR POINTER INITIALIZATION.

POINTERS TO SUBROUTINES (REGULAR CALL).

POINTERS TO SUBROUTINES ('NEW INSTRUCTION' CALL).

MISCELLANEOUS POINTERS.

RUN TERMINATION.

PRINT OUT SIGN-ON, ASK INITIAL QUESTIONS, AND SET UP 'FLAG' FOR BOARD PRINTOUT.

SET UP WAIT LIST CONTROLS AND CLEAR OUT MOVE ARRAY.

READ IN USER'S MOVE AND STORE IN 'ROW', 'COLUMN', AND 'PLANE'.

CHECK MOVE FOR LEGALITY, AND STORE A 1 IN THE INDICATED MOVE ARRAY LOCATION.

303-321	CALL 'STRAT', CHECK IF A SITUATION WAS FOUND, AND IF NOT, SELECT A WAITING MOVE.
322-324	PRINT TIE GAME MESSAGE.
325-334	TEST FOR WIN OR LOSS.
335-351	PUT A 5 IN THE COMPUTER'S MOVE LOCATION, PRINT THE MOVE, AND, IF FLAG=0, PRINT THE BOARD.
352-354	PRINT ILLEGAL MOVE MESSAGE.
355-357	PRINT WIN MESSAGE.
360-361	PRINT LOSS MESSAGE.
362-365	PRINT WINNING ROW AND BOARD.
400-405	ASK ABOUT ANOTHER GAME.
406-413	ONE-CHARACTER PRINT.
414-443	ONE-CHARACTER READ AND TEST FOR CONTROL CHARACTERS.
444-455	'TESTAC' ROUTINE.
456-470	CHANGE ROW, COLUMN, PLANE TO MOVE SUBSCRIPT.
471-536	CONVERT SUBSCRIPT (1-64) TO ROW, COLUMN, PLANE.
537-572	INITIALIZE 'STRAT', SUM UP ALL WINNING PATHS.
600-770	STRAT'S 8 NESTED LOOPS.
777-1023	PROCESS RETURNS FROM 'STRAT'.
1024-1111	BOARD PRINTOUT ROUTINE.
1200-1253	MESSAGE PRINTOUT ROUTINE (FROM DIGITAL-8-18-U-SYM).
1254-1306	ANSWER PROCESSING ROUTINE.

1307-1327

PRINT OUT COORDINATES OF WINNING
ROW AND SET THE MOVE ARRAY
LOCATIONS FOR THAT ROW = -1
AS A FLAG FOR THE BOARD PRINT-
OUT ROUTINE.

1330-1427

MOVE ARRAY.

1430-1543

SUM ARRAY.

1544-1567

WAIT LIST.

1570-2247

ROW ARRAY.

2250-2316

TEST ARRAY.

2317-3143

TEXT MESSAGES.

(NOTE: THIS SEGMENT WAS CODED
INTO OCTAL BY A SMALL EDITING
ROUTINE.)

REFERENCES

1. LOUDEN, ROBERT K., "PROGRAMMING THE IBM 1130 AND 1800,"
PRENTICE HALL, 1967

APPENDIX A - BOARD PRINTOUT

AT THE END OF EVERY GAME AND, IF DESIRED, AFTER EVERY MOVE MADE BY THE COMPUTER, THE PLAYING CUBE IS PRINTED ON THE TELETYPE. THE 3 DIMENSIONAL BOARD IS DISPLAYED BY PRINTING ITS FOUR HORIZONTAL PLANES IN THE ORDER OF TOPMOST TO BOTTOM. EACH PLANE IS PRINTED WITH ROW 1, COLUMN 1 AT THE UPPER LEFT-HAND CORNER. BLANK SQUARES ARE OBVIOUSLY NOT OCCUPIED, AN 'O', SIGNIFIES OCCUPATION BY THE HUMAN OPPONENT, AN 'X' INDICATES OCCUPATION BY THE COMPUTER, AND A '*' IS A SQUARE ON THE WINNING ROW AT THE END OF A GAME. THE 'BOARD PRINTOUT' OPTION IS PROVIDED TO AVOID THE LONG PRINTOUT CYCLE AFTER EVERY EXCHANGE OF MOVES, BUT SUPPRESSING THIS ACTION NECESSITATES RECORDING MOVES WITH SOME OTHER VISUAL AID. MOVES MAY BE RECORDED ON A COMMERCIAL THREE DIMENSIONAL TOY BOARD OR ON A GRID SIMILAR TO THE ONE USED IN THE BOARD PRINTOUT PREPARED AND DUPLICATED BEFOREHAND.

APPENDIX B - SAMPLE GAME

THIS IS QUBIC, 3D TIC-TAC-TOE

DO YOU WANT AN EXPLANATION OF HOW TO PLAY ? YES

THIS PROGRAM PLAYS TIC-TAC-TOE ON A 4 BY 4 BY 4 CUBE.
THE OBJECT IS TO GET 4 SQUARES IN A ROW, EITHER VERTICALLY,
DIAGONALLY OR HORIZONTALLY THROUGH THE CUBE. INPUT MOVES AS ROW,
COLUMN, PLANE. IF YOU DO NOT WANT THE BOARD PRINTED OUT AT EVERY STEP,
ANSWER 'NO' TO THE QUESTION 'BOARD PRINTOUT ?'. OTHERWISE,
THE BOARD IS PRINTED WITH YOU AS 'O', THE COMPUTER
AS 'X', AND THE WINNING ROW AS '*' .

BOARD PRINTOUT ? NO

SHALL I GO FIRST ? FLICK LIVES

PLEASE ANSWER 'YES' OR 'NO'.

SHALL I GO FIRST ? NO

YOUR MOVE IS 9,9,9

THAT MOVE IS ILLEGAL. TRY AGAIN.

YOUR MOVE IS P,Q,-

YOUR MOVE IS 2,2,2

I MOVE 3,3,3

YOUR MOVE IS 3,3,2

I MOVE 3,2,2

YOUR MOVE IS 3,1,1

I MOVE 2,3,3

YOUR MOVE IS 1,3,3

I MOVE 2,2,3

YOUR MOVE IS 1,1,3

I MOVE 1,1,2

YOUR MOVE IS 3,4,4

I MOVE 2,3,2

YOUR MOVE IS 1,4,2

I MOVE 1,4,3

YOUR MOVE IS 2,-

YOUR MOVE IS 3,2,3

I MOVE 3,1,4

YOUR MOVE IS 2,3,4

I MOVE 4,1,4

YOUR MOVE IS 2,1,4

I MOVE 2,4,4

YOUR MOVE IS 3,1,3

I MOVE 2,1,3

YOUR MOVE IS 2,4,3

I MOVE 4,1,1

YOUR MOVE IS 1,1,4

I WIN ON 3,2,2 2,3,3 1,4,4 4,1,1

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HOW ABOUT ANOTHER GAME ? NO THANKS!

THANK YOU FOR AN ENJOYABLE GAME.

APPENDIX C - PROGRAM LISTING

/3D TIC-TAC-TOE, BY TIM YEAGER ***

/PAGE 0

/INDEX REGISTERS

*10

0010	0000	XR1,	0
0011	0000	XR2,	0
0012	0000	XR3,	0
0013	0000	XR4,	0
0014	0000	XR5,	0
0015	0000	XR6,	0
0016	0000	XR7,	0
0017	0000	XR8,	0

/NUMERICAL CONSTANTS

0020	7777	MINUS1,	-1
0021	7775	MINUS3,	-3
0022	7774	M4,	-4
0023	7773	M5,	-5
0024	7754	M20,	-24
0025	7763	M13,	-15
0026	7664	M76,	-114
0027	7700	M64,	-100
0030	7520	M260,	-260
0031	7563	MCR,	-215
0032	0005	P5,	5
0033	0114	P76,	114
0034	0261	K261,	261
0035	0212	LF,	212
0036	0240	SPACE,	240
0037	0254	COMMA,	254

/VARIABLE STORAGE

0040	0000	ROW,	0
0041	0000	COLUMN,	0
0042	0000	PLANE,	0
0043	0000	NEXT,	0
0044	0000	SAVE,	0
0045	0000	FLAG,	0

/USED BY 'STRAT'

0046	0000	XSUM,	0
0047	0000	TEST1,	0
0050	0000	TEST2,	0
0051	0000	TEST3,	0
0052	0000	M1,	0

0053 0000 M2, 0
 0054 0000 M3, 0
 0055 0000 WAITP, 0
 0056 0000 WAITCT, 0

0057 0000 COUNT1, 0
 0060 0000 COUNT2, 0
 0061 0000 COUNT3, 0
 0062 0000 COUNT4, 0
 0063 0000 COUNT5, 0
 0064 0000 COUNT6, 0
 0065 0000 COUNT7, 0
 0066 0000 COUNT8, 0

/ADDRESS INITIALIZATION ***

0067 1327 MOVEP, MOVE-1
 0070 1544 WAITL, WAITLST
 0071 1427 SUMP, SUM-1
 0072 1567 ROWP, ROWLST-1
 0073 2247 TESTP, TEST-1

/SUBROUTINE POINTERS

0074 1254 YESNO, XYESNO
 0075 1200 MESSAGE, PRNTXT
 0076 0471 CONVRT, XCNVRT
 0077 0456 CODE, XCODE
 0100 1024 BOARD, CUBE
 0101 0537 STRAT, STRTG

0102 0444 TESTAC=JMS I . ; XTSTAC
 0103 0414 READC=JMS I . ; XREADC
 0104 0406 PRINTC=JMS I . ; XPRNTC

/GENERAL POINTERS

0105 0400 ENDGAM, TRYAGN
 0106 1002 RETRN1, RTRN01
 0107 1012 RETRN2, RTRN02
 0110 1014 RETRN3, RTRN03

*175

0175 4475 STPROG, JMS I MESSAGE
 0176 3076 TEXT16
 0177 7402 HLT

PAUSE

/MAIN PROGRAM ***

0200	6032	KCC
0201	6046	TLS
0202	4475	JMS I MESSAGE
0203	2317	TEXT01
0204	4474	JMS I YESNO
0205	5210	JMP .+3
0206	4475	JMS I MESSAGE
0207	2367	TEXT03
0210	4475	JMS I MESSAGE
0211	3131	TEXT17
0212	4474	JMS I YESNO
0213	7040	CMA
0214	3045	DCA FLAG

0215	1070	SETUP, TAD WAITL
0216	3055	DCA WAITP
0217	1024	TAD M20
0220	3056	DCA WAITCT
0221	1027	TAD M64
0222	3057	DCA COUNT1
0223	1067	TAD MOVEP
0224	3010	DCA XR1
0225	3410	DCA I XR1
0226	2057	ISZ COUNT1
0227	5225	JMP .-2

0230	4475	JMS I MESSAGE
0231	2704	TEXT04
0232	4474	JMS I YESNO
0233	7410	SKP
0234	5303	JMP DECIDE

/GET OPPONENT'S MOVE

0235	4475	GETMV, JMS I MESSAGE
0236	2720	TEXT05
0237	4503	READC
0240	3040	DCA ROW
0241	1037	TAD COMMA
0242	4504	PRINTC
0243	4503	READC
0244	3041	DCA COLUMN
0245	1037	TAD COMMA
0246	4504	PRINTC
0247	4503	READC
0250	3042	DCA PLANE

/CHECK FOR LEGALITY

0251	1040	TAD ROW
0252	4502	TESTAC

0253	5352	JMP ILLEGL
0254	1041	TAD COLUMN
0255	4502	TESTAC
0256	5352	JMP ILLEGL
0257	1042	TAD PLANE
0260	4502	TESTAC
0261	5352	JMP ILLEGL
0262	1040	TAD ROW
0263	1030	TAD M260
0264	3040	DCA ROW
0265	1041	TAD COLUMN
0266	1030	TAD M260
0267	3041	DCA COLUMN
0270	1042	TAD PLANE
0271	1030	TAD M260
0272	3042	DCA PLANE
0273	4477	JMS I CODE
0274	1067	TAD MOVEP
0275	3043	DCA NEXT
0276	1443	TAD I NEXT
0277	7640	SZA CLA
0300	5352	JMP ILLEGL
0301	7001	IAC
0302	3443	DCA I NEXT

/MAKE COMPUTER'S MOVE

0303	4501	DECIDE, JMS I STRAT
0304	1052	TAD M1
0305	7640	SZA CLA
0306	5325	JMP SITFND
0307	1455	TAD I WAITP
0310	3052	DCA M1
0311	1052	TAD M1
0312	1067	TAD MOVEP
0313	3044	DCA SAVE
0314	1444	TAD I SAVE
0315	7650	SNA CLA
0316	5340	JMP COMOVE
0317	2055	ISZ WAITP
0320	2056	ISZ WAITCT
0321	5307	JMP .-12

/TIE GAME ***

0322	4475	JMS I MESSAGE
0323	2763	TEXT08
0324	5505	JMP I ENDGAM

/TEST FOR WIN OR LOSE

0325	7240	SITFND, CLA CMA
0326	1054	TAD M3
0327	7650	SNA CLA

0330	5360	JMP WELOSE
0331	7344	CLA CLL CMA RAL
0332	1054	TAD M3
0333	7650	SNA CLA
0334	5355	JMP WEWON

/NORMAL MOVE ***

0335	1067	TAD MOVEP
0336	1052	TAD M1
0337	3044	DCA SAVE
0340	1032	COMOVE, TAD P5
0341	3444	DCA I SAVE
0342	4475	JMS I MESSAGE
0343	2755	TEXT07
0344	1052	TAD M1
0345	4476	JMS I CONVRT
0346	1045	TAD FLAG
0347	7700	SMA CLA
0350	4500	JMS I BOARD
0351	5235	JMP GETMV
0352	4475	ILLEGL, JMS I MESSAGE
0353	2731	TEXT06
0354	5235	JMP GETMV

0355	4475	WEWON, JMS I MESSAGE
0356	3010	TEXT10
0357	5362	JMP .+3

0360	4475	WELOSE, JMS I MESSAGE
0361	3000	TEXT09

/PRINT OUT WINNING ROW

0362	4765	JMS I WINROW
0363	4500	JMS I BOARD
0364	5505	JMP I ENDGAME
0365	1307	WINROW, XWNROW

*400

0400	4475	TRYAGN, JMS I MESSAGE
0401	3017	TEXT11
0402	4474	JMS I YESNO
0403	5175	JMP STPROG
0404	5605	JMP I .+1
0405	0215	SETUP

PAUSE
/SUBROUTINES (1)

0406	0000	XPRNTC, 0
0407	6041	TSF
0410	5207	JMP --1
0411	6046	TLS
0412	7200	CLA
0413	5606	JMP I XPRNTC

0414	0000	XREADC, 0
0415	6031	KSF
0416	5215	JMP --1
0417	6036	KRB
0420	6046	TLS
0421	3044	DCA SAVE
0422	1044	TAD SAVE
0423	1240	TAD MNCODE
0424	7650	SNA CLA
0425	5505	JMP I ENDGAME
0426	1044	TAD SAVE
0427	1241	TAD MARROW
0430	7650	SNA CLA
0431	5643	JMP I LASTMV
0432	1044	TAD SAVE
0433	1242	TAD MSCODE
0434	7650	SNA CLA
0435	5175	JMP STPROG
0436	1044	TAD SAVE
0437	5614	JMP I XREADC
0440	7562	MNCODE, -216
0441	7441	MARROW, -337
0442	7555	MSCODE, -223
0443	0235	LASTMV, GETMV

/SKIP IF 260<AC<265

0444	0000	XTSTAC, 0
0445	1030	TAD M260
0446	7550	SPA SNA
0447	5254	JMP XRTRN
0450	1023	TAD M5
0451	7700	SMA CLA
0452	5254	JMP XRTRN
0453	2244	ISZ XTSTAC
0454	7200	XRTRN, CLA
0455	5644	JMP I XTSTAC

/CHANGE ROW, COLUMN, PLANE TO 1-64

0456	0000	XCODE, 0	18
0457	7240	CLA CMA	
0460	1042	TAD PLANE	

0461	7106	CLL RTL
0462	3044	DCA SAVE
0463	7240	CLA CMA
0464	1041	TAD COLUMN
0465	1044	TAD SAVE
0466	7106	CLL RTL
0467	1040	TAD ROW
0470	5656	JMP I XCODE

/CONVERT MOVE CODE TO ROW,COLUMN,PLANE

0471	0000	XCNVRT, 0
0472	1020	TAD MINUS1
0473	3044	DCA SAVE
0474	1044	TAD SAVE
0475	7110	CLL RAR
0476	7110	CLL RAR
0477	7110	CLL RAR
0500	7110	CLL RAR
0501	3042	DCA PLANE
0502	1042	TAD PLANE
0503	7106	CLL RTL
0504	7006	RTL
0505	7041	CIA
0506	1044	TAD SAVE
0507	7110	CLL RAR
0510	7110	CLL RAR
0511	3041	DCA COLUMN
0512	1042	TAD PLANE
0513	7106	CLL RTL
0514	1041	TAD COLUMN
0515	7006	RTL
0516	7041	CIA
0517	1044	TAD SAVE
0520	3040	DCA ROW
0521	1040	TAD ROW
0522	1034	TAD K261
0523	4504	PRINTC
0524	1037	TAD COMMA
0525	4504	PRINTC
0526	1041	TAD COLUMN
0527	1034	TAD K261
0530	4504	PRINTC
0531	1037	TAD COMMA
0532	4504	PRINTC
0533	1042	TAD PLANE
0534	1034	TAD K261
0535	4504	PRINTC
0536	5671	JMP I XCNVRT

PAUSE

/SUBROUTINE STRAT

0537	0000	STRTG,	0
0540	1071		TAD SUMP
0541	3010		DCA XR1
0542	1072		TAD ROWP
0543	3011		DCA XR2
0544	1026		TAD M76
0545	3057		DCA COUNT1
0546	3046	SUMLOP,	DCA XSUM
0547	1022		TAD M4
0550	3060		DCA COUNT2
0551	1411		TAD I XR2
0552	3044		DCA SAVE
0553	1046		TAD XSUM
0554	1444		TAD I SAVE
0555	3046		DCA XSUM
0556	2060		ISZ COUNT2
0557	5351		JMP --6
0560	1046		TAD XSUM
0561	3410		DCA I XR1
0562	2057		ISZ COUNT1
0563	5346		JMP SUMLOP

/SET UP OUTSIDE LOOP COUNTR

0564	1025		TAD M13
0565	3057		DCA COUNT1
0566	1073		TAD TESTP
0567	3010		DCA XR1
0570	3054		DCA M3
0571	5772		JMP I .+1
0572	0600		SCAN01

/NESTED LOOPS

*600

0600	2054	SCAN01,	ISZ M3
0601	1410		TAD I XR1
0602	3047		DCA TEST1
0603	1410		TAD I XR1
0604	3050		DCA TEST2
0605	1410		TAD I XR1
0606	3051		DCA TEST3

/SKIP IF TEST NO. > 0

0607	1047		TAD TEST1
0610	7740		SMA SZA CLA
0611	5366		JMP DONE01

/FIND A ROW WITH A SUM OF TEST1

0612	1071		TAD SUMP
0613	3011		DCA XR2
0614	1026		TAD M76

0615	3060	DCA COUNT2
0616	1411	SCAN02, TAD I XR2
0617	1047	TAD TEST1
0620	7640	SZA CLA
0621	5364	JMP DONE02
0622	7344	CLA CLL CMA RAL
0623	1054	TAD M3
0624	7750	SPA SNA CLA
0625	5506	JMP I RETRN1

/FIND A BLANK SQUARE M1 ON THE ROW WITH SUM OF TEST1

0626	1033	TAD P76
0627	1060	TAD COUNT2
0630	7106	CLL RTL
0631	1072	TAD ROWP
0632	3012	DCA XR3
0633	1022	TAD M4
0634	3061	DCA COUNT3
0635	1412	SCAN03, TAD I XR3
0636	3052	DCA M1
0637	1452	TAD I M1
0640	7640	SZA CLA
0641	5362	JMP DONE03
0642	1050	TAD TEST2
0643	7740	SMA SZA CLA
0644	5507	JMP I RETRN2

/FIND A ROW WITH A SUM OF TEST2

0645	1071	TAD SUMP
0646	3013	DCA XR4
0647	1026	TAD M76
0650	3062	DCA COUNT4
0651	1413	SCAN04, TAD I XR4
0652	1050	TAD TEST2
0653	7640	SZA CLA
0654	5360	JMP DONE04
0655	1011	TAD XR2
0656	7041	CIA
0657	1013	TAD XR4
0660	7650	SNA CLA
0661	5360	JMP DONE04

/FIND THE BLANK SQUARE M1 ON ROW WITH SUM=TEST2

0662	1033	TAD P76
0663	1062	TAD COUNT4
0664	7106	CLL RTL
0665	1072	TAD ROWP
0666	3014	DCA XR5

0667	1014	TAD XR5
0670	3015	DCA XR6
0671	1022	TAD M4
0672	3063	DCA COUNT5
0673	1414	SCAN05, TAD I XR5
0674	7041	CIA
0675	1052	TAD M1
0676	7640	SZA CLA
0677	5356	JMP DONE05
0700	1051	TAD TEST3
0701	7740	SMA SZA CLA
0702	5507	JMP I RETRN2

/FIND ANY BLANK SQUARE M2 ON ROW WITH SUM=TEST2

0703	1022	TAD M4
0704	3064	DCA COUNT6
0705	1415	SCAN06, TAD I XR6
0706	3053	DCA M2
0707	1453	TAD I M2
0710	7640	SZA CLA
0711	5354	JMP DONE06

/FIND A ROW WHOSE SUM = TEST3

0712	1071	TAD SUMP
0713	3016	DCA XR7
0714	1026	TAD M76
0715	3065	DCA COUNT7

0716	1416	SCAN07, TAD I XR7
0717	1051	TAD TEST3
0720	7640	SZA CLA
0721	5352	JMP DONE07

/TEST IF SAME ROW AS FOR TEST1, TEST2

0722	1016	TAD XR7
0723	7041	CIA
0724	1011	TAD XR2
0725	7650	SNA CLA
0726	5352	JMP DONE07
0727	1016	TAD XR7
0730	7041	CIA
0731	1013	TAD XR4
0732	7650	SNA CLA
0733	5352	JMP DONE07

/FIND THE BLANK SQUARE M2 ON THE ROW WITH SUM = TEST3

0734	1033	TAD P76
0735	1065	TAD COUNT7
0736	7106	CLL RTL
0737	1072	TAD ROWP

0740	3017	DCA XR8
0741	1022	TAD M4
0742	3066	DCA COUNT8
0743	1417	SCAN08, TAD I XR8
0744	7041	CIA
0745	1053	TAD M2
0746	7650	SNA CLA
0747	5510	JMP I RETRN3

/LOOP ENDS ***

0750	2066	DONE08, ISZ COUNT8
0751	5343	JMP SCAN08
0752	2065	DONE07, ISZ COUNT7
0753	5316	JMP SCAN07
0754	2064	DONE06, ISZ COUNT6
0755	5305	JMP SCAN06
0756	2063	DONE05, ISZ COUNT5
0757	5273	JMP SCAN05
0760	2062	DONE04, ISZ COUNT4
0761	5251	JMP SCAN04
0762	2061	DONE03, ISZ COUNT3
0763	5235	JMP SCAN03
0764	2060	DONE02, ISZ COUNT2
0765	5216	JMP SCAN02
0766	2057	DONE01, ISZ COUNT1
0767	5200	JMP SCAN01
0770	5377	JMP ENDPAGE

*777

0777	3052	ENDPAGE, DCA M1
1000	3053	DCA M2
1001	5220	JMP RETURN

/RETURNS FROM STRAT ***

/WIN OR LOSE - M1 A ROW SUBSCRIPT ***

1002	1033	RTRN01, TAD P76
1003	1060	TAD COUNT2
1004	7106	CLL RTL
1005	1072	TAD ROWP
1006	7001	IAC
1007	3052	DCA M1

1010	3053		DCA M2
1011	5220		JMP RTURN
1012	7300	RTRN02,	CLA CLL
1013	3053		DCA M2
1014	1067	RTRN03,	TAD MOVEP
1015	7041		CIA
1016	1052		TAD M1
1017	3052		DCA M1
1020	1623	RTURN,	TAD I STRTPT
1021	3044		DCA SAVE
1022	5444		JMP I SAVE
1023	0537	STRTPT,	STRTG

PAUSE

/SUBROUTINE BOARD *** PRINT-OUT OF BOARD

1024	0000	CUBE,	0
1025	1035		TAD LF
1026	4504		PRINTC
1027	1022		TAD M4
1030	3057		DCA COUNT1
1031	7201		CLA IAC
1032	3042		DCA PLANE
1033	4475	PLNLOP,	JMS I MESSAGE
1034	3057		TEXT13
1035	1022		TAD M4
1036	3060		DCA COUNT2
1037	7201		CLA IAC
1040	3040		DCA ROW
1041	4475	ROWLOP,	JMS I MESSAGE
1042	3072		TEXT14
1043	1022		TAD M4
1044	3061		DCA COUNT3
1045	7201		CLA IAC
1046	3041		DCA COLUMN
1047	4477	COLOOP,	JMS I CODE
1050	1067		TAD MOVEP
1051	3044		DCA SAVE
1052	1444		TAD I SAVE
1053	7450		SNA
1054	5264		JMP PRTSPC
1055	7510		SPA
1056	5304		JMP STAR
1057	1023		TAD M5
1060	7650		SNA CLA
1061	1307		TAD XCDE
1062	1310		TAD OCODE
1063	7410		SKP
1064	1036	PRTSPC,	TAD SPACE
1065	4504		PRINTC
1066	4475		JMS I MESSAGE
1067	3074		TEXT15
1070	2041		ISZ COLUMN
1071	2061		ISZ COUNT3
1072	5247		JMP COLOOP
1073	4475		JMS I MESSAGE
1074	3057		TEXT13
1075	2040		ISZ ROW
1076	2060		ISZ COUNT2
1077	5241		JMP ROWLOP
1100	2042		ISZ PLANE
1101	2057		ISZ COUNT1
1102	5233		JMP PLNLOP

1103	5624		JMP I CUBE
1104	7200	STAR,	CLA
1105	1311		TAD CSTAR
1106	5265		JMP PRTSPC+1
1107	0011	XCDE,	11
1110	0317	OCODE,	317
1111	0252	CSTAR,	252

/MESSAGE PRINT OUT ***

*1200

1200	0000	PRNTXT,	0
1201	7240		CLA CMA
1202	1600		TAD I PRNTXT
1203	3010		DCA 10
1204	2200		ISZ PRNTXT
1205	1410		TAD I 10
1206	3217		DCA MSRGHT
1207	1217		TAD MSRGHT
1210	7012		RTR
1211	7012		RTR
1212	7012		RTR
1213	4220		JMS TYPECH
1214	1217		TAD MSRGHT
1215	4220		JMS TYPECH
1216	5205		JMP PRNTXT+5
1217	0000	MSRGHT,	0

1220	0000	TYPECH,	0
1221	0247		AND MASK77
1222	7450		SNA
1223	5600		JMP I PRNTXT
1224	1250		TAD M40
1225	7500		SMA
1226	5231		JMP .+3
1227	1251		TAD C340
1230	5244		JMP MTP
1231	1021		TAD MINUS3
1232	7440		SZA
1233	5236		JMP .+3
1234	1035		TAD LF
1235	5244		JMP MTP
1236	1252		TAD XM2
1237	7440		SZA
1240	5243		JMP .+3
1241	1246		TAD CR
1242	5244		JMP MTP
1243	1253		TAD C245
1244	4504	MTP,	PRINTC
1245	5620		JMP I TYPECH

1246	0215	CR,	215
1247	0077	MASK77,	77
1250	7740	M40,	-40
1251	0340	C340,	340
1252	7776	XM2,	-2
1253	0245	C245,	245

/SUBROUTINE YESNO ***

1254	0000	XYESNO,	0
1255	4503		READC
1256	1305		TAD MYES
1257	7450		SNA
1260	5276		JMP YES
1261	1306		TAD MNO
1262	7650		SNA CLA
1263	5277		JMP NO
1264	4503		READC
1265	1031		TAD MCR
1266	7640		SZA CLA
1267	5264		JMP --3
1270	4475		JMS I MESSAGE
1271	3036		TEXT12
1272	1254		TAD XYESNO
1273	1021		TAD MINUS3
1274	3254		DCA XYESNO
1275	5654		JMP I XYESNO
1276	2254	YES,	ISZ XYESNO
1277	7200	NO,	CLA
1300	4503		READC
1301	1031		TAD MCR
1302	7640		SZA CLA
1303	5300		JMP NO+1
1304	5654		JMP I XYESNO

1305	7447	MYES,	-331
1306	0013	MNO,	331-316

1307	0000	XWNROW,	0
1310	1022		TAD M4
1311	3057		DCA COUNT1
1312	1452	WINRW,	TAD I M1
1313	3044		DCA SAVE
1314	7240		CLA CMA
1315	3444		DCA I SAVE
1316	1067		TAD MOVEP
1317	7041		CIA
1320	1044		TAD SAVE
1321	4476		JMS I CONVRT
1322	1036		TAD SPACE
1323	4504		PRINTC
1324	2052		ISZ M1
1325	2057		ISZ COUNT1
1326	5312		JMP WINRW

1327 5707

JMP I XWNROW

MOVE=.

M=-1

*.+100

SUM=.

*.+114

WAITLIST=.

DECIMAL

/WAIT LIST:

1544 0026

1545 0053

1546 0027

1547 0052

1550 0032

1551 0047

1552 0033

1553 0046

1554 0001

1555 0100 22; 43; 23; 42; 26; 39; 27; 38; 1; 64

1556 0015

1557 0064

1560 0004

1561 0075

1562 0020

1563 0061

1564 0026

1565 0053

1566 0027

1567 0052 13; 52; 4; 61; 16; 49; 22; 43; 23; 42

PAUSE

ROWLIST=.

/ROW ARRAY:

1570 1355

1571 1402

1572 1427

1573 1330 22+M; 43+M; 64+M; 1+M

1574 1356

1575 1401

1576 1424

1577	1333	23+M;	42+M;	61+M;	4+M
1600	1361				
1601	1376				
1602	1413				
1603	1344	26+M;	39+M;	52+M;	13+M
1604	1362				
1605	1375				
1606	1410				
1607	1347	27+M;	38+M;	49+M;	16+M
1610	1355				
1611	1401				
1612	1425				
1613	1331	22+M;	42+M;	62+M;	2+M
1614	1356				
1615	1402				
1616	1426				
1617	1332	23+M;	43+M;	63+M;	3+M
1620	1356				
1621	1375				
1622	1414				
1623	1337	23+M;	38+M;	53+M;	8+M
1624	1362				
1625	1401				
1626	1420				
1627	1343	27+M;	42+M;	57+M;	12+M
1630	1361				
1631	1375				
1632	1411				
1633	1345	26+M;	38+M;	50+M;	14+M
1634	1362				
1635	1376				
1636	1412				
1637	1346	27+M;	39+M;	51+M;	15+M
1640	1355				
1641	1376				
1642	1417				
1643	1334	22+M;	39+M;	56+M;	5+M
1644	1361				
1645	1402				
1646	1423				
1647	1340	26+M;	43+M;	60+M;	9+M
1650	1355				
1651	1375				
1652	1415				
1653	1335	22+M;	38+M;	54+M;	6+M
1654	1356				
1655	1376				
1656	1416				
1657	1336	23+M;	39+M;	55+M;	7+M
1660	1361				
1661	1401				
1662	1421				
1663	1341	26+M;	42+M;	58+M;	10+M
1664	1362				

1665	1402				
1666	1422				
1667	1342	27+M;	43+M;	59+M;	11+M
1670	1355				
1671	1356				
1672	1357				
1673	1354	22+M;	23+M;	24+M;	21+M
1674	1361				
1675	1362				
1676	1363				
1677	1360	26+M;	27+M;	28+M;	25+M
1700	1355				
1701	1361				
1702	1365				
1703	1351	22+M;	26+M;	30+M;	18+M
1704	1356				
1705	1362				
1706	1366				
1707	1352	23+M;	27+M;	31+M;	19+M
1710	1355				
1711	1362				
1712	1367				
1713	1350	22+M;	27+M;	32+M;	17+M
1714	1356				
1715	1361				
1716	1364				
1717	1353	23+M;	26+M;	29+M;	20+M
1720	1375				
1721	1376				
1722	1377				
1723	1374	38+M;	39+M;	40+M;	37+M
1724	1401				
1725	1402				
1726	1403				
1727	1400	42+M;	43+M;	44+M;	41+M
1730	1375				
1731	1401				
1732	1405				
1733	1371	38+M;	42+M;	46+M;	34+M
1734	1376				
1735	1402				
1736	1406				
1737	1372	39+M;	43+M;	47+M;	35+M
1740	1375				
1741	1402				
1742	1407				
1743	1370	38+M;	43+M;	48+M;	33+M
1744	1376				
1745	1401				
1746	1404				
1747	1373	39+M;	42+M;	45+M;	36+M
1750	1424				
1751	1330				
1752	1354				

1753	1400	61+M;	1+M;	21+M;	41+M
1754	1427				
1755	1333				
1756	1357				
1757	1403	64+M;	4+M;	24+M;	44+M
1760	1410				
1761	1333				
1762	1352				
1763	1371	49+M;	4+M;	19+M;	34+M
1764	1424				
1765	1347				
1766	1366				
1767	1405	61+M;	16+M;	31+M;	46+M
1770	1410				
1771	1344				
1772	1360				
1773	1374	49+M;	13+M;	25+M;	37+M
1774	1413				
1775	1347				
1776	1363				
1777	1377	52+M;	16+M;	28+M;	40+M
2000	1413				
2001	1330				
2002	1351				
2003	1372	52+M;	1+M;	18+M;	35+M
2004	1427				
2005	1344				
2006	1365				
2007	1406	64+M;	13+M;	30+M;	47+M
2010	1410				
2011	1330				
2012	1350				
2013	1370	49+M;	1+M;	17+M;	33+M
2014	1413				
2015	1333				
2016	1353				
2017	1373	52+M;	4+M;	20+M;	36+M
2020	1424				
2021	1344				
2022	1364				
2023	1404	61+M;	13+M;	29+M;	45+M
2024	1427				
2025	1347				
2026	1367				
2027	1407	64+M;	16+M;	32+M;	48+M
2030	1333				
2031	1330				
2032	1331				
2033	1332	4+M;	1+M;	2+M;	3+M
2034	1347				
2035	1344				
2036	1345				
2037	1346	16+M;	13+M;	14+M;	15+M
2040	1344				

2041	1330				
2042	1334				
2043	1340	13+M;	1+M;	5+M;	9+M
2044	1347				
2045	1333				
2046	1337				
2047	1343	16+M;	4+M;	8+M;	12+M
2050	1347				
2051	1330				
2052	1335				
2053	1342	16+M;	1+M;	6+M;	11+M
2054	1344				
2055	1333				
2056	1336				
2057	1341	13+M;	4+M;	7+M;	10+M
2060	1413				
2061	1410				
2062	1411				
2063	1412	52+M;	49+M;	50+M;	51+M
2064	1427				
2065	1424				
2066	1425				
2067	1426	64+M;	61+M;	62+M;	63+M
2070	1424				
2071	1410				
2072	1414				
2073	1420	61+M;	49+M;	53+M;	57+M
2074	1427				
2075	1413				
2076	1417				
2077	1423	64+M;	52+M;	56+M;	60+M
2100	1427				
2101	1410				
2102	1415				
2103	1422	64+M;	49+M;	54+M;	59+M
2104	1424				
2105	1413				
2106	1416				
2107	1421	61+M;	52+M;	55+M;	58+M
2110	1351				
2111	1371				
2112	1411				
2113	1331	18+M;	34+M;	50+M;	2+M
2114	1352				
2115	1372				
2116	1412				
2117	1332	19+M;	35+M;	51+M;	3+M
2120	1354				
2121	1374				
2122	1414				
2123	1334	21+M;	37+M;	53+M;	5+M
2124	1357				
2125	1377				
2126	1417				

2127	1337	24+M;	40+M;	56+M;	8+M
2130	1360				
2131	1400				
2132	1420				
2133	1340	25+M;	41+M;	57+M;	9+M
2134	1363				
2135	1403				
2136	1423				
2137	1343	28+M;	44+M;	60+M;	12+M
2140	1365				
2141	1405				
2142	1425				
2143	1345	30+M;	46+M;	62+M;	14+M
2144	1366				
2145	1406				
2146	1426				
2147	1346	31+M;	47+M;	63+M;	15+M
2150	1335				
2151	1336				
2152	1337				
2153	1334	6+M;	7+M;	8+M;	5+M
2154	1341				
2155	1342				
2156	1343				
2157	1340	10+M;	11+M;	12+M;	9+M
2160	1335				
2161	1341				
2162	1345				
2163	1331	6+M;	10+M;	14+M;	2+M
2164	1336				
2165	1342				
2166	1346				
2167	1332	7+M;	11+M;	15+M;	3+M
2170	1351				
2171	1352				
2172	1353				
2173	1350	18+M;	19+M;	20+M;	17+M
2174	1365				
2175	1366				
2176	1367				
2177	1364	30+M;	31+M;	32+M;	29+M
2200	1354				
2201	1360				
2202	1364				
2203	1350	21+M;	25+M;	29+M;	17+M
2204	1357				
2205	1363				
2206	1367				
2207	1353	24+M;	28+M;	32+M;	20+M
2210	1371				
2211	1372				
2212	1373				
2213	1370	34+M;	35+M;	36+M;	33+M
2214	1405				

2215	1406				
2216	1407				
2217	1404	46+M;	47+M;	48+M;	45+M
2220	1374				
2221	1400				
2222	1404				
2223	1370	37+M;	41+M;	45+M;	33+M
2224	1377				
2225	1403				
2226	1407				
2227	1373	40+M;	44+M;	48+M;	36+M
2230	1415				
2231	1416				
2232	1417				
2233	1414	54+M;	55+M;	56+M;	53+M
2234	1421				
2235	1422				
2236	1423				
2237	1420	58+M;	59+M;	60+M;	57+M
2240	1415				
2241	1421				
2242	1425				
2243	1411	54+M;	58+M;	62+M;	50+M
2244	1416				
2245	1422				
2246	1426				
2247	1412	55+M;	59+M;	63+M;	51+M

TEST=.

/TEST ARRAY:

2250	7774			
2251	0001			
2252	0001	-4;	1;	1
2253	7761			
2254	0001			
2255	0001	-15;	1;	1
2256	7775			
2257	0001			
2260	0001	-3;	1;	1
2261	7766			
2262	7766			
2263	0001	-10;	-10;	1
2264	7766			
2265	7773			
2266	7766	-10;	-5;	-10
2267	7776			
2270	7776			
2271	0001	-2;	-2;	1
2272	7776			
2273	7777			
2274	7776	-2;	-1;	-2

2275	7776			
2276	7777			
2277	7777	-2;	-1;	-1
2300	7776			
2301	0000			
2302	7776	-2;	0;	-2
2303	7773			
2304	7773			
2305	7766	-5;	-5;	-10
2306	7773			
2307	7773			
2310	7773	-5;	-5;	-5
2311	7773			
2312	0000			
2313	7766	-5;	0;	-10
2314	7773			
2315	0000			
2316	7773	-5;	0;	-5

OCTAL

PAUSE

/TEXT MESSAGES ***

2317	4543	TEXT01, 4543
2320	2410	2410
2321	1123	1123
2322	4011	4011
2323	2340	2340
2324	2125	2125
2325	0211	0211
2326	0354	0354
2327	4063	4063
2330	0440	0440
2331	2411	2411
2332	0355	0355
2333	2401	2401
2334	0355	0355
2335	2417	2417
2336	0545	0545
2337	4343	4343
2340	0417	0417
2341	4031	4031
2342	1725	1725
2343	4027	4027
2344	0116	0116
2345	2440	2440
2346	0116	0116
2347	4005	4005
2350	3020	3020
2351	1401	1401
2352	1601	1601
2353	2411	2411

2354	1716	1716
2355	4017	4017
2356	0640	0640
2357	1017	1017
2360	2740	2740
2361	2417	2417
2362	4020	4020
2363	1401	1401
2364	3140	3140
2365	7740	7740
2366	0000	0000
2367	4543	TEXT03, 4543
2370	4324	4324
2371	1011	1011
2372	2340	2340
2373	2022	2022
2374	1707	1707
2375	2201	2201
2376	1540	1540
2377	2014	2014
2400	0131	0131
2401	2340	2340
2402	2411	2411
2403	0355	0355
2404	2401	2401
2405	0355	0355
2406	2417	2417
2407	0540	0540
2410	1716	1716
2411	4001	4001
2412	4064	4064
2413	4002	4002
2414	3140	3140
2415	6440	6440
2416	0231	0231
2417	4064	4064
2420	4003	4003
2421	2502	2502
2422	0556	0556
2423	4543	4543
2424	2410	2410
2425	0540	0540
2426	1702	1702
2427	1205	1205
2430	0324	0324
2431	4011	4011
2432	2340	2340
2433	2417	2417
2434	4007	4007
2435	0524	0524
2436	4064	4064
2437	4023	4023
2440	2125	2125

2441	0122	0122
2442	0523	0523
2443	4011	4011
2444	1640	1640
2445	0140	0140
2446	2217	2217
2447	2754	2754
2450	4005	4005
2451	1124	1124
2452	1005	1005
2453	2240	2240
2454	2605	2605
2455	2224	2224
2456	1103	1103
2457	0114	0114
2460	1431	1431
2461	5445	5445
2462	4304	4304
2463	1101	1101
2464	0717	0717
2465	1601	1601
2466	1414	1414
2467	3140	3140
2470	1722	1722
2471	4010	4010
2472	1722	1722
2473	1132	1132
2474	1716	1716
2475	2401	2401
2476	1414	1414
2477	3140	3140
2500	2410	2410
2501	2217	2217
2502	2507	2507
2503	1040	1040
2504	2410	2410
2505	0540	0540
2506	0325	0325
2507	0205	0205
2510	5640	5640
2511	1116	1116
2512	2025	2025
2513	2440	2440
2514	1517	1517
2515	2605	2605
2516	2340	2340
2517	0123	0123
2520	4022	4022
2521	1727	1727
2522	5445	5445
2523	4303	4303
2524	1714	1714
2525	2515	2515
2526	1654	1654

2527	4020	4020
2530	1401	1401
2531	1605	1605
2532	5640	5640
2533	1106	1106
2534	4031	4031
2535	1725	1725
2536	4004	4004
2537	1740	1740
2540	1617	1617
2541	2440	2440
2542	2701	2701
2543	1624	1624
2544	4024	4024
2545	1005	1005
2546	4002	4002
2547	1701	1701
2550	2204	2204
2551	4020	4020
2552	2211	2211
2553	1624	1624
2554	0504	0504
2555	4017	4017
2556	2524	2524
2557	4001	4001
2560	2440	2440
2561	0526	0526
2562	0522	0522
2563	3140	3140
2564	2324	2324
2565	0520	0520
2566	5445	5445
2567	4301	4301
2570	1623	1623
2571	2705	2705
2572	2240	2240
2573	4716	4716
2574	1747	1747
2575	4024	4024
2576	1740	1740
2577	2410	2410
2600	0540	0540
2601	2125	2125
2602	0523	0523
2603	2411	2411
2604	1716	1716
2605	4047	4047
2606	0217	0217
2607	0122	0122
2610	0440	0440
2611	2022	2022
2612	1116	1116
2613	2417	2417
2614	2524	2524

2615	4077	4077
2616	4756	4756
2617	4017	4017
2620	2410	2410
2621	0522	0522
2622	2711	2711
2623	2305	2305
2624	5445	5445
2625	4324	4324
2626	1005	1005
2627	4002	4002
2630	1701	1701
2631	2204	2204
2632	4011	4011
2633	2340	2340
2634	2022	2022
2635	1116	1116
2636	2405	2405
2637	0440	0440
2640	2711	2711
2641	2410	2410
2642	4031	4031
2643	1725	1725
2644	4001	4001
2645	2340	2340
2646	4717	4717
2647	4754	4754
2650	4024	4024
2651	1005	1005
2652	4003	4003
2653	1715	1715
2654	2025	2025
2655	2405	2405
2656	2245	2245
2657	4301	4301
2660	2340	2340
2661	4730	4730
2662	4754	4754
2663	4001	4001
2664	1604	1604
2665	4024	4024
2666	1005	1005
2667	4027	4027
2670	1116	1116
2671	1611	1611
2672	1607	1607
2673	4022	4022
2674	1727	1727
2675	4001	4001
2676	2340	2340
2677	4752	4752
2700	4740	4740
2701	5645	5645
2702	4343	4343

2703 4300 4300

2704 4543 TEXT04, 4543

2705 4323 4323

2706 1001 1001

2707 1414 1414

2710 4011 4011

2711 4007 4007

2712 1740 1740

2713 0611 0611

2714 2223 2223

2715 2440 2440

2716 7740 7740

2717 0000 0000

2720 4543 TEXT05, 4543

2721 4331 4331

2722 1725 1725

2723 2240 2240

2724 1517 1517

2725 2605 2605

2726 4011 4011

2727 2340 2340

2730 0000 0000

2731 4543 TEXT06, 4543

2732 4324 4324

2733 1001 1001

2734 2440 2440

2735 1517 1517

2736 2605 2605

2737 4011 4011

2740 2340 2340

2741 1114 1114

2742 1405 1405

2743 0701 0701

2744 1456 1456

2745 4024 4024

2746 2231 2231

2747 4001 4001

2750 0701 0701

2751 1116 1116

2752 5645 5645

2753 4343 4343

2754 0000 0000

2755 4543 TEXT07, 4543

2756 4311 4311

2757 4015 4015

2760 1726 1726

2761 0540 0540

2762 0000 0000

2763 4543 TEXT08, 4543

2764	4314	4314
2765	0524	0524
2766	4723	4723
2767	4003	4003
2770	0114	0114
2771	1440	1440
2772	2410	2410
2773	1123	1123
2774	4001	4001
2775	4024	4024
2776	1105	1105
2777	5600	5600

3000	4543	TEXT09, 4543
3001	4331	4331
3002	1725	1725
3003	4027	4027
3004	1116	1116
3005	4017	4017
3006	1640	1640
3007	0000	0000

3010	4543	TEXT10, 4543
3011	4311	4311
3012	4027	4027
3013	1116	1116
3014	4017	4017
3015	1640	1640
3016	0000	0000

3017	4543	TEXT11, 4543
3020	4310	4310
3021	1727	1727
3022	4001	4001
3023	0217	0217
3024	2524	2524
3025	4001	4001
3026	1617	1617
3027	2410	2410
3030	0522	0522
3031	4007	4007
3032	0115	0115
3033	0540	0540
3034	7740	7740
3035	0000	0000

3036	4543	TEXT12, 4543
3037	4320	4320
3040	1405	1405
3041	0123	0123
3042	0540	0540
3043	0116	0116
3044	2327	2327
3045	0522	0522

3046	4047	4047
3047	3105	3105
3050	2347	2347
3051	4017	4017
3052	2240	2240
3053	4716	4716
3054	1747	1747
3055	5645	5645
3056	4300	4300

3057	4543	TEXT13, 4543
3060	5656	5656
3061	5656	5656
3062	5656	5656
3063	5656	5656
3064	5656	5656
3065	5656	5656
3066	5656	5656
3067	5656	5656
3070	5645	5645
3071	4300	4300

3072	5640	TEXT14, 5640
3073	0000	0000

3074	4056	TEXT15, 4056
3075	4000	4000

3076	4543	TEXT16, 4543
3077	4324	4324
3100	1001	1001
3101	1613	1613
3102	4031	4031
3103	1725	1725
3104	4006	4006
3105	1722	1722
3106	4001	4001
3107	1640	1640
3110	0516	0516
3111	1217	1217
3112	3101	3101
3113	0214	0214
3114	0540	0540
3115	0701	0701
3116	1505	1505
3117	5645	5645
3120	4343	4343
3121	4343	4343
3122	4343	4343
3123	4343	4343
3124	4343	4343
3125	4343	4343
3126	4343	4343
3127	4343	4343

3130	0000	0000
3131	4543	TEXT17, 4543
3132	4302	4302
3133	1701	1701
3134	2204	2204
3135	4020	4020
3136	2211	2211
3137	1624	1624
3140	1725	1725
3141	2440	2440
3142	7740	7740
3143	0000	0000

BOARD	0100
CODE	0077
COLOOP	1047
COLUMN	0041
COMMA	0037
COMOVE	0340
CONVRT	0076
COUNT1	0057
COUNT2	0060
COUNT3	0061
COUNT4	0062
COUNT5	0063
COUNT6	0064
COUNT7	0065
COUNT8	0066
CR	1246
CSTAR	1111
CUBE	1024
C245	1253
C340	1251
DECIDE	0303
DONE01	0766
DONE02	0764
DONE03	0762
DONE04	0760
DONE05	0756
DONE06	0754
DONE07	0752
DONE08	0750
ENDGAM	0105
ENDPAG	0777
FLAG	0045
GETMV	0235
ILLEGL	0352
K261	0034
LASTMV	0443
LF	0035
M	1327

MARROW	0441
MASK77	1247
MCR	0031
MESSAGE	0075
MINUS1	0020
MINUS3	0021
MNCODE	0440
MNO	1306
MOVE	1330
MOVEP	0067
MSCODE	0442
MSRGHT	1217
MTP	1244
MYES	1305
M1	0052
M13	0025
M2	0053
M20	0024
M260	0030
M3	0054
M4	0022
M40	1250
M5	0023
M64	0027
M76	0026
NEXT	0043
NO	1277
OCODE	1110
PLANE	0042
PLNLOP	1033
PRINTC	4504
PRNTXT	1200
PRTSPC	1064
P5	0032
P76	0033
READC	4503
RETRN1	0106
RETRN2	0107
RETRN3	0110
ROW	0040
ROWLOP	1041
ROWLST	1570
ROWP	0072
RTRN01	1002
RTRN02	1012
RTRN03	1014
RTURN	1020
SAVE	0044
SCAN01	0600
SCAN02	0616
SCAN03	0635
SCAN04	0651
SCAN05	0673
SCAN06	0705

SCAN07	0716
SCAN08	0743
SETUP	0215
SITFND	0325
SPACE	0036
STAR	1104
STPROG	0175
STRAT	0101
STRTG	0537
STRTPT	1023
SUM	1430
SUMLOP	0546
SUMP	0071
TEST	2250
TESTAC	4502
TESTP	0073
TEST1	0047
TEST2	0050
TEST3	0051
TEXT01	2317
TEXT03	2367
TEXT04	2704
TEXT05	2720
TEXT06	2731
TEXT07	2755
TEXT08	2763
TEXT09	3000
TEXT10	3010
TEXT11	3017
TEXT12	3036
TEXT13	3057
TEXT14	3072
TEXT15	3074
TEXT16	3076
TEXT17	3131
TRYAGN	0400
TYPECH	1220
WAITCT	0056
WAITL	0070
WAITLS	1544
WAITP	0055
WELOSE	0360
WEWON	0355
WINROW	0365
WINRW	1312
XCDE	1107
XCNVRT	0471
XCODE	0456
XM2	1252
XPRNTC	0406
XREADC	0414
XRTRN	0454
XR1	0010
XR2	0011

XR3	0012
XR4	0013
XR5	0014
XR6	0015
XR7	0016
XR8	0017
XSUM	0046
XTSTAC	0444
XWNROW	1307
XYESNO	1254
YES	1276
YESNO	0074